



## Business Case BC-FY01-22

**Project Name:** Capability Maturity Model Implementation

**Channel:** CIO

**Project Sponsor:** Helene Epstein

**Project Lead:** Connie Davis

### **Project Description**

**Describe the need for change (the business problem to be addressed).**

Student Financial Assistance is making a significant investment in a Modernization Program that impacts many of the functional, technical and organizational aspects of the business. The Modernization Program is focused on achieving SFA's performance objectives associated with its role as the government's first PBO. In support of this effort several new Information Technology solution projects are being implemented in a short timeframe.

As part of the modernization program, SFA has to plan, budget, develop and implement Information Technology solutions valued at hundreds of millions of dollars. In review of the development and delivery process of these complex solutions, SFA has identified the need to implement a repeatable software development process to help mitigate the risk of missed quality expectations, late delivery, or system failure.

The evidence indicates that unlike some competing models and techniques, many organizations achieved demonstrable results from using the capability maturity model (CMM) as a basis for product quality and delivery improvements. Based on proven industry results, SFA has identified the CMM process model, as the model which will best enable the organization to meet the modernization business objectives.

The CMM effort will also enable SFA to compare this process improvement program against an accepted industry standard of process maturity. As a PBO, this measure will help SFA validate its process improvement and process maturity with other government agencies and private industry in its pursuit of a best in class software solution delivery program. The SFA will improve their ability to ensure solutions consistently meet customer needs and expectations, customer quality objectives and delivery commitments and timeline.

### **Capability Maturity Model Defined**

The Capability Maturity Model for software is a set of guidelines for twenty-three Key Process Areas related to software development and maintenance; each of these Key Process Areas contain a set of defined goals. These Key Process Areas include items such as Requirements Management, Software Project Planning, and Software Configuration Management. The premise is that the most successful software organizations are those that do at least these twenty-three things well. The Capability Maturity Model organizes the Key Process Areas into five stages, or levels, of process maturity. Level 1 organizations have satisfied none, or few, of the goals of the Key Process Areas, while Level 5 organizations have satisfied the goals of all Key Process Areas.

### **Industry Benefits**

We expect SFA will realize a number of benefits by using the Capability Maturity Model as one part of the process improvement program. The Software Engineering Institute (SEI) published results of Capability Maturity Model-



based process improvement programs based on case studies from 13 organizations (CMU/SEI-94-TR-013). The results are impressive:

- Improvement in early detection of defects: 6% - 25%
- Reduced delivery time: 15% - 23%
- Reduced post-production defects: 10% - 94%
- Return on Investment of improvement program: 400% - 880%

This process improvement program will establish a baseline of the current environment and use real observations and details, to evaluate long term improvement opportunities.

### **Additional Industry detail**

The Giga Information Group reports that the leading cause of project failure is failure to meet project or customer requirements.<sup>1</sup> These failures can occur because the business process and the application software requirements were not originally well understood, because the software specifications did not match the requirements, or because the software drifted away from meeting the requirements during the development process.

A study of 8,380 systems operated by 365 respondents in an array of small to large organizations showed the following results:

- of the development projects only 16.2% were completed with full requirements, on time and in budget,
- 52.7% were concluded with less than full requirements or with unfavorable variances to time and budget,
- and 31.1% were terminated without completion.<sup>2</sup>

#### Critical Success Factors

User involvement  
Clear statement of [process and  
application] requirements  
Realistic expectations

#### Critical Failure Factors

Incomplete requirements  
Lack of user involvement  
Unrealistic expectations

A study of software development and acquisition projects showed that 30% were cancelled before completion, and 50% were completed but were 80% or more over budget.<sup>3</sup>

### **Capability Maturity Model Detail**

The Capability Maturity Model (CMM) for Software provides software organizations with guidance on how to gain control of their processes for developing and maintaining software and how to evolve toward a culture of software engineering and management excellence. The CMM was designed to guide software organizations in selecting process improvement strategies by determining current process maturity and identifying the few issues most critical to software quality and process improvement. By focusing on a limited set of activities and working aggressively to achieve them, an organization can steadily improve its organization-wide software process to enable continuous and lasting gains in software process capability.

In an immature organization, there is no objective basis for judging product quality or for solving product or process problems. Therefore, product quality is difficult to predict. Activities intended to enhance quality such as reviews and testing are often curtailed or eliminated when projects fall behind schedule.

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<sup>1</sup> Carl Zetie, *Implementing Requirements Management*, Giga Information Group, P-0799-007, July 1999, page 1.

<sup>2</sup> *Chaos*, (a report), The Standish Group, June 1997, <http://www.standishgroup.com/chaos.html>

<sup>3</sup> The Meta Group, 1997.



On the other hand, a mature software organization possesses an organization-wide ability for managing software development and maintenance processes. The software process is accurately communicated to both existing staff and new employees. Additionally, work activities are carried out according to the planned process. The processes mandated are usable and consistent with the way the work actually gets done. These defined processes are updated when necessary, and improvements are developed through controlled pilot-tests and/or cost benefit analyses. Roles and responsibilities within the defined process are clear throughout the project and across the organization.

A maturity level is a well-defined evolutionary plateau toward achieving a mature software process. Each maturity level comprises a set of process goals that, when satisfied, stabilize an important component of the software process. Achieving each level of the maturity framework establishes a different component in the software process, resulting in an increase in the process capability of the organization.

The CMM is organized into five maturity levels. The SFA IPTs are currently at the Initial Level 1. At Level 1 the software process is characterized as ad hoc, and occasionally even chaotic. Few processes are defined, and success depends on individual effort and heroics. Except for Level 1, each maturity level is decomposed into several **key process areas (KPs)** that indicate the areas an organization should focus on to improve its software process.

The key process areas at Level 2 focus on the software project's concerns related to establishing basic project management controls. They are:

- **Requirements Management**
- **Software Project Planning**
- **Software Project Tracking and Oversight**
- **Software Subcontract Management**
- **Software Quality Assurance**
- **and Software Configuration Management**

The key process areas at Level 3 address both project and organizational issues, as the organization establishes an infrastructure that institutionalizes effective software engineering and management processes across all projects. They are:

- **Organization Process Focus**
- **Organization Process Definition (a.k.a. SDLC)**
- **Training Program**
- **Integrated Software Management**
- **Software Product Engineering**
- **Inter-group Coordination**
- **and Peer Reviews**

### **Business Case Objective:**

This Business Case includes initiatives that will help SFA projects mature to levels 2 and 3 of the CMM. It includes:

- Deployment and support of the SDLC process guide across the SFA IPTs
- Baseline of the current organizations process maturity
- Development and roll-out of SDLC process and procedures which support compliance to CMM level 2 Key process areas
- Support the use of CMM based processes with select IPT's
- The establishment of a Process Improvement Program and Software Engineering Process Group(SEPG)to provide ongoing support
- A process support tool strategy
- Process repository



### **System Development Life Cycle (SDLC)**

It is crucial that any software development organization establishes and follows a systems development life cycle methodology to support software development in a structured, methodical, repeatable manner. An SDLC is vital to SFA's success in developing software and managing the software development process. The SFA SDLC needs to be continually improved and deployed with orientation and formal training for the SFA IPTs. Standards need to be identified and documented. The SDLC will incorporate key process areas for CMM Level 2 and specific CMM level 3 KPAs.

### **What is the purpose of the initiative?**

The purpose of this initiative is to establish a Process Improvement Program and Software Engineering Process Group (SEPG) to implement the key process areas (KPAs) toward reaching CMM Level 3. As a result processes, tools, and support that will be used by the Integrated Product Teams and the Chief Information Office to deliver and maintain IT solutions for the SFA Enterprise. Specifically this initiative will deliver the following:

Baseline current SFA process capability – Plan and conduct an assessment of the current SFA process maturity. Identify best practices, processes for reuse and gaps. Prioritize gap areas to address and incorporate into the process improvement plan.

Systems Development Life Cycle (SDLC)– Deploy, support and improve the SFA Systems Development Life Cycle process guide. The establishment of the SDLC process guide is required to achieve the **Level 3 KPA Organization Process Definition (OPD)**. Deployment of the SDLC CMM level 2 processes, includes designing, documenting and developing basic process training courses for the IPTs. This will partially satisfy the **Level 3 Training Program KPA**.

**The SDLC will address the following CMM level 2 KPAs:**

- Requirements Management (RM)
- Configuration Management (CM)
- Software Project Planning (SPP)
- Software Project Tracking and Oversight (SPTO)
- Software Subcontract Management (SSM)
- Software Quality Assurance – (SQA) Integrate process and procedures already available from eCAD quality Assurance team

**The SDLC will address the following CMM level 3 KPAs:**

- Organization Process Definition (OPD)
- Organization Process Focus (OPF)
- Peer Review (PR)

Software Engineering Process Group (SEPG) – A SEPG will be established to manage the Process Improvement Program. The Establishment of the program will satisfy the the **Level 3 KPA Organization Process Focus (OPF)**.

Tool Evaluation – Evaluate SDLC work flow and project management tools for use by Integrated Product Teams that will automate the SDLC process and standard deliverable templates.

### **What is the scope of the initiative, including what it is not?**

The scope of this initiative is to implement the following initiatives towards increasing the maturity of projects in accordance with the CMM.

By December the Modernization Partner will deliver the new SDLC process guide. It will describe the use of specific tools and templates, a repeatable development process, deliverable outcomes, signoff controls, roles and



responsibilities, and change management. The scope of this initiative will be to further enhance and improve existing processes, develop needed procedures for CMM level 2 compliance and deploy the SDLC methodology.

SDLC process guide mainstreaming will include providing orientation and or “boot camp” training and mentoring to IPTs. The SDLC will be maintained under a continuous process improvement program in order to help projects comply with level 2 of the Software Engineer Institute’s (SEI) Capability Maturity Model (CMM). Tools will be evaluated to automate process and project management work flows for implementing the SDLC.

The scope of the SDLC begins when an Investment Decision approves a new initiative during the Investment Review Process and continues through System Support and Maintenance for modernization efforts. Although the SDLC interfaces with and incorporates templates used in investment reviews and acquisition/procurement, the SDLC scope does not duplicate the Investment Review and Acquisition and Procurement processes.

**What is the start date and end date of the initiative?**

Start January 02, 2001 through September 01, 2001. Extended annually thereafter.

**What other business areas/external groups are affected by the implementation of this initiative and how are they affected?**

For each funded modernization initiative an IPT will be staffed with SFA business area and Modernization Partner contractor personnel. The IPT will be required to use the SDLC and CMM process to guide the implementation of the modernization project. The goal of this initiative is to build process maturity into each IPT so that the SFA organization can be assessed at higher maturity levels against an industry accepted standard (the CMM). Therefore, all SFA business areas and modernization contractors are affected by the implementation of this initiative.

**What systems are impacted by the implementation of this initiative and how are they impacted?**

Every system that is subject to development or replacement under the Modernization program, will be affected because all aspects of the initiative will guide the system development process and the people conducting it. All IPTs will need to consider the impact of implementing the SDLC and CMM processes within their project work plans.

**What business processes are impacted by the implementation of this initiative and how are they impacted?**

SFA’s core Business Processes, per se, will not be impacted directly but indirectly by the implementation of this initiative. Every business process that imposes Information Technology requirements upon any system will be affected.

The SFA Modernization Blueprint defines the Information Technology Process for the Enterprise Services Business Area. The Information Technology Management process ensures that SFA’s systems have common standards, are secure, readily integrate and interface with channel partners, and keep pace with new technologies and technology requirements. Specific sub-processes that will be impacted by this initiative are (IT-03) IT Systems Development Lifecycle and (IT-09) Configuration Management.

**Technologies Used**



Name/type	Proposed use	Has technology been used at SFA before? Where?	Does Technology fit SFA's Architecture Standard? Explain.	Does SFA have the technical expertise to implement this technology? Why?
SEI Capability Maturity Model (CMM)	Use as a framework for ensuring that best practices are incorporated into the SDLC.	Yes, when SFA contractor's implemented projects at CMM level 2 or higher.	Yes, it provides for an open life cycle.	Yes, via Modernization Partner and their subcontractors.

### **Benefits**

Provide a narrative discussion to explain why SFA is doing the initiative and what project objectives or expected outcomes can be quantified and how can they be measured. Demonstrate that the initiative supports the goals and objectives of SFA, how it supports these goals and objectives, to what extent it helps SFA achieve these goals and objectives and when these benefits will be realized.

#### ***Reduce Unit Cost***

Quantified Benefit (\$)	How will benefit be measured/realized?	When will benefit be realized?
Reduction in the number of scope and requirements changes during the build phase of the SDLC.	The SDLC will require projects to track changes via the requirements and change management processes.	As projects begin tracking change requests, a decrease in overall changes during the build phase should begin to occur.
Reduction in the number of problem reports and cost of rework during the testing and acceptance phases of the SDLC.	The SDLC will require projects to undergo IV&V reviews, track problem reports and cost of rework during testing and acceptance phases.	As projects undergo IV&V reviews and implement corrective actions, the number of problem reports and cost of rework should be reduced, due to better quality assurance.
<i>Assumptions</i>		

#### **Increase Customer Satisfaction**

Quantified/Qualitative Benefit	How will benefit be measured/realized?	When will benefit be realized?
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Reduction in changes resulting from customer reviews and signoff.	The SDLC will require that the results of customer reviews are documented and the amount of changes monitored.	When the time for customer reviews and sign off are reduced as a result of reduced comments and changes.
Customer satisfaction is measured as a direct result of acceptance testing and operations.	The SDLC will require that projects measure customer satisfaction via surveys etc. at project initiation and as a part of acceptance and operations.	When a direct improvement of customer satisfaction can be compared against an established baseline for each project.
This program would enhance SFA's comfort level of releasing quality products to the customer.	Successful IV&V, SI&T, and security assessment.	Upon production release and implementation.
Minimize customer complaints and maximize satisfaction based on an enterprise approach to Quality Assurance.	Call Center metrics. Previous Production Releases and Implementations, which were done without any QA program.	Upon production release and implementation.
<i>Assumptions</i>		

***Increase Employee Satisfaction***

<b>Quantified/Qualitative Benefit</b>	<b>How will benefit be measured/realized?</b>	<b>When will benefit be realized?</b>
Employees have a greater understanding of their roles on an IPT.	IPT members will provide feedback on the orientation and/or training of the SDLC and CMM processes. The IPT members will provide feedback on the use of the processes.	Positive feedback from orientation and training courses and through the use of the processes the need for modifications is reduced over time.
Employees can concentrate on enhancing service to customers in lieu of reacting to problem reports.	Compare call Center metrics. Previous Production Releases and Implementations, which were done without any repeatable processes.	Upon production release and implementation.
SFA responsiveness to external audits is enhanced with this program in place.	Improved quality of contract deliverables resulting from this initiative.	Throughout the SDLC.
<i>Assumptions</i>		



**Other Benefits include the following:**

The CMM was designed to guide software organizations in selecting process improvement strategies by determining current process maturity and identifying the few issues most critical to software quality and process improvement. With this initiative, SFA will focus on a limited set of initiatives and work aggressively to achieve them. By doing so, the organization will steadily improve its organization-wide software process to enable continuous and lasting gains in software process capability.

The documented case studies of software process improvement indicate that there are significant improvements in both quality and productivity as a result of the improvement effort. The return on investment seems to typically be in the 5:1 to 8:1 range for successful process improvement efforts.

The SDLC is vital to SFA's success in guiding the Integrated Product Teams. The use of a standard SDLC should reduce both the overall IT resources spent on software maintenance and the amount of a development time devoted to testing and rework below 50%. It also will incorporate best practices to ensure that SFA development is efficient, cost effective and uses standards.

Estimated overall dollar amount of all benefits listed above.

Quantified Benefits					
BY	BY+1	BY+2	BY+3	BY+4	Total
	3,315,000	5,100,000			
Assumptions					
Based on Industry Published CMM implementation data, the return on investment is between 3:1 and 8:1 per dollar invested, through lower cost over-runs, rework, productivity gains and production support costs. We will assume the low end of the investment ROI industry average based on the fixed price nature of development efforts and large contractor base. Data is also limited on rework and quality costs and task order overruns.					

**Costs**

Provide costs, including those to implement the initiative and the costs to support it over its useful life.

COSTS						
	BY	BY+1	BY+2	BY+3	BY+4	Total
CMM Development	1,105,000	1,200,000				
CMM Level 2		500,000				





<b>Deployment</b>						
<b>Operations</b>						
<b>Prod. Proc</b>						
<b>Key Pers.</b>						
<b>Ad Hoc</b>						
<b>Sys. Maint.</b>			150,000	150,000	150,000	150,000
<b>Telecom.</b>						
<b>Data Center</b>						
<b>Sub. Ops</b>						
<b>Total</b>	1,105,000	1,700,000	150,000	150,000	150,000	150,000
<i>Assumptions</i>						
<b><u>PLEASE SEE FINANCIAL ANALYSIS SECTION FOR DETAILS AND ASSUMPTIONS.</u></b>						

### **Total Cost of Ownership**

What is the level of required enhancement after implementation?

The level of required enhancements after implementation is unknown at this time and will be based on feedback from orientation, training and use of the processes.

What is the life span of this initiative?

The life span of these initiatives will be ongoing. Enhancements or changes will depend on the pace of changes to the SFA organization and the ever-changing technologies, tools and methodologies created for systems development.

### **Alternatives**

Discuss what could be done in place in this initiative and describe the consequences of each alternative.

<b>Alternatives</b>	<b>Consequence</b>
Remain as-is	– SFA will not have a clear methodology, best practices, templates etc for



	<p>developing SFA systems.</p> <ul style="list-style-type: none"><li>– The lack of repeatable processes will continue to foster imprecision in our current development activities, which is a significant cost multiplier for every IPT or application.</li><li>– Suffer inefficient and ineffective element that could be avoided by the use of better tools and management. This is not economically feasible, and has a high risk of negative political consequences in the form of dissatisfied customers.</li><li>– SFA would remain without enterprise-wide CMM processes, which would impact the ability of SFA executives to effectively manage changes to business processes and technical architecture/application components. With the number of individual IPTs currently in process and planned within SFA, central coordination of the activities and results of these IPTs is crucial to achieving the business benefits of these IPT initiatives.</li><li>– SFA Project Managers would not have a consistent model on which to develop project plans, which inhibit the efficient and timely implementation of applications across the SFA enterprise.</li><li>– As a PBO, SFA will have a limited ability to compare it's capabilities across other government agencies and the industry against accepted industry standards.</li></ul>
Non-technology solution	<ul style="list-style-type: none"><li>– In order for the SDCL and CMM processes to be effectively implemented, the use of workflow and project management tools may be needed. This will ensure consistency across the enterprise, and enable the IPTs with automated storage and retrieval of reusable project plans and templates. This will work to reduce unit costs, a key PBO objective.</li></ul>
Enhance an existing system	<ul style="list-style-type: none"><li>– N/A</li></ul>
Implement on a smaller scale	<ul style="list-style-type: none"><li>– To truly reap the benefits of cost avoidance, better quality software, lower costs, etc. this initiative cannot be considered an all or nothing proposition. SFA can implement each project IPT by IPT without creating an enterprise capability. But a disciplined, repeatable enterprise capability would not exist as required by the SEI Capability Maturity Models.</li><li>– Development of enterprise-wide CM procedures must be performed at the enterprise level.</li></ul>
Other	N/A

## **Risks**

<b>Risk</b>	<b>Description of Risk</b>	<b>Mitigation Strategy</b>
Financial	Funding is exhausted and the SDLC is incomplete.	Award a fixed price performance based task order.
Technology	With the implementation of multiple applications and architectures within SFA, the possibility remains high that integration between these architectures and applications is less than effective at best, and conflicting at worst.	Work to ensure that the SDLC and CMM processes address effectively managing the technology implementations across the enterprise.
Scope	The scope of the SFA modernization activities	Ensure that the implemented CM procedures



	must be carefully managed in order to ensure that the modernization projects stay on budget, within schedule, and realize the full benefits as outlined in the modernization blueprint and the PBO objectives.	enable SFA to balance the modernization schedule and costs with the need to quickly resolve design and implementation issues that arise.
Management	CIO and customer management loses visibility into the application development process.  With the implementation of multiple applications across SFA, executive leadership needs to be able to effectively coordinate the implementation of additional business capabilities, and reduce the possibility of blueprint objectives not being achieved.	The CM procedures must ensure that the Modernization blueprint and IPT Business Cases are aligned, and that all new business capabilities are focused on achieving the benefits outlined in these documents.
Exposure	High exposure to SFA leadership and project sponsor if major software development effort fails.  As the first Federal PBO, the visibility of SFA as it attempts to successfully achievement its Modernization Blueprint objectives is extremely high.	A sound SDLC enhances early recognition and avoidance of risk. Risk is dealt with early in the project where costs or correction or mitigation are much lower.  SFA Executive management must approve and closely coordinate the development of the enterprise-wide CM approach.

### **Acquisition Strategy**

**Sources** (Indicate the prospective sources of supplies or services that can meet the need of this project. List the most likely offerors for the requirement, and/or the manufacturer and model of the equipment that will most likely be offered).

Initiative	Sources
• CMM Implementation	Mod Partner

**Competition** (Describe how competition will be sought, promoted, and sustained throughout the course of the acquisition, including any performance requirements that will be required).

This initiative will be awarded via task orders on the SFA Modernization Partner contract. The modernization partner may utilize multiple sub contractors to ensure the best value and resources for multiple tasks under one large task order.

Initiative	Sources
• CMM Implementation	Mod Partner w/ subcontractors Impact Innovations Gimmel Systems CSC, Inc. NCS EDS Others TBD



**Contract Considerations** (For each contract contemplated, discuss contract type selection; use of multiyear contracting, options, or other special contracting methods, ex: performance-based).

Contract	Task Order Type
Mod Partner	Performance Based Firm fixed task order

**Schedule/Milestones (including acquisition cycle) (TBD)**

Individual schedules/milestones are currently being developed for each initiative acquisition vehicle.

#	Milestone	Start Date	End Date
	<ul style="list-style-type: none"><li>• <b>Mod Partner Task Order</b></li></ul>	<b>01/02/01</b>	<b>09/30/01</b>
	– Project Plan	01/02/01	01/15/01
	– CMM Gap Assessment (not a full CBA-IPI)	1/15/01	02/15/01
	– SEPG CMM training		
	– CMM Level 2 KPA	2/01/01	02/10/00
	Process/procedure/template and training course development	2/15/01	09/01/01
	– Requirements Management		
	– Configuration Management		
	– Software Project Planning		
	– Software Project Tracking and Oversight		
	– Software Subcontract Management		
	– Software Quality Assurance		
	CMM Level 3 KPA Process/procedure and training course development		
	– Organization Process Definition		
	– Organization Process Focus		
	– Peer Review		